ART 34 AMDT



Claims

1. A process for the removal of oxygen from a gas mixture comprising oxygen, at least one olefin, hydrogen, carbon monoxide and optionally at least one alkyne, the ratio of oxygen : hydrogen in the gas mixture being 1 part by volume of oxygen to at least 5 parts by volume of hydrogen, which process comprises contacting the gas mixture with a catalyst in a reaction zone under conditions sufficient to oxidise at least a portion of the hydrogen and to oxidise at least a portion of the carbon monoxide and without significant hydrogenation of the at least one olefin, wherein the catalyst comprises at least one metal or oxide of a metal from the $10^{th}$ group of the Periodic Table of Elements, the metal or oxide of the metal being supported on an oxide support, provided that the catalyst also comprises tin.

2. A process for the removal of oxygen and alkyne from a gas mixture comprising oxygen, at least one olefin, hydrogen, carbon monoxide and at least one alkyne, the ratio of oxygen : hydrogen in the gas mixture being at least 1 part by volume of oxygen to at least 5 parts by volume of hydrogen, which process comprises contacting the gas mixture with a catalyst in a reaction zone under conditions sufficient to oxidise at least a portion of the hydrogen and to oxidise at least a portion of the carbon monoxide and without significant hydrogenation of the at least one olefin, wherein the catalyst comprises at least one metal or oxide of a metal selected from the group consisting of the $10^{th}$ group and the $11^{th}$ group of the Periodic Table of Elements, the metal or oxide of the metal being supported on an oxide support, provided that where the catalyst comprises at least one metal or oxide of a metal from the $10^{th}$ group of the Periodic Table of Elements supported on an oxide support, the catalyst also comprises tin and

provided that where the catalyst comprises at least one metal or oxide of a metal of the 11th group of the Periodic Table of Elements the oxide support is a zeolite.

3. A process according to claim 1 or claim 2 wherein the gas mixture contains 2000 ppm or less of oxygen.

4. A process according to any one of claims 1 to 3 wherein the gas mixture comprises at least 10 vol% of hydrogen.

5. A process according to claim 4 in which the gas mixture comprises at least 20 vol % hydrogen.

6 A process according to any one of the preceding claims in which the gas mixture comprises from greater than 0 up to and including 20 vol % alkyne.

7. A process according to claim 6 in which the alkyne is acetylene.

8. A process according to anyone of claims 2 to 7 wherein the catalyst comprises at least 0.01wt%, based on the total weight of the dry catalyst, of at least one metal or oxide of a metal selected from copper, silver and gold, supported on a zeolite support.

9. A process according to claim 8 in which the catalyst comprises copper in an amount in the range of from 1 to 15 wt %.

10. A process according to claim 8 or claim 9 wherein the zeolite is zeolite A or zeolite X.

11. A process according to any one of claims 1 to 7 in which the catalyst comprises at least 0.01wt%, based on the total weight of the dry catalyst, of at least one metal or oxide of a metal selected from nickel, palladium and platinum supported on silica or alumina.

12. A process according to claim 11 wherein the metal is platinum and is present in an amount in the range 0.01 – 15 wt% based on the total weight of the dry catalyst and is supported on silica.

13. A process according to claim 11 or claim 12 wherein tin is present in the catalyst in an amount in the range 0.01 to 60 wt% based on the total dry weight of the catalyst.

14. A process according to any one of the preceding claims wherein the gas mixture is contacted with the catalyst in the reaction zone at a temperature in the range 50-300° C.

15. A process according to anyone of the preceding claims wherein the gas mixture is contacted with the catalyst in the reaction zone at a total pressure in the range 15-35 bara.

16. A process according to any one of the preceding claims wherein the process comprises the steps :

(a) contacting at least one hydrocarbon with a molecular oxygen-containing gas in a first reaction zone with a catalyst capable of supporting combustion beyond the normal fuel-rich limit of flammability and wherein the stoichiometric ratio of hydrocarbon to oxygen is 5 to 16 times the stoichiometric ratio of hydrocarbon to molecular oxygen-containing gas for complete combustion to carbon dioxide and water, to produce a product stream comprising oxygen, at least one olefin, hydrogen, carbon monoxide and optionally at least one alkyne,

(b) contacting in a second reaction zone, at least a portion of the product stream from step (a) having a ratio of oxygen to hydrogen of at least one part by volume of oxygen to at least 5 parts by volume of hydrogen with a catalyst under conditions sufficient to oxidise at least a portion of the hydrogen and to oxidise at least a portion of the carbon monoxide and without significant hydrogenation of the at least one olefin, wherein the catalyst comprises at least one metal or oxide of a metal selected from the group consisting of the $10^{th}$ group and the $11^{th}$ group of the Periodic Table of Elements, the metal oxide of the metal being supported on an oxide support, provided that where the catalyst comprises at least one metal or oxide of a metal from the $10^{th}$ group of the Periodic Table of Elements supported on an oxide support, the catalyst also comprises tin and provided that where the catalyst comprises at least one metal or oxide of a metal of the $11^{th}$ group of the Periodic Table of Elements the oxide support is a zeolite.